

REMARKS

Claims 1-9, 11-13, 19-22, 26-35, 37-57, 59-61, and 63-70 are now pending.

The Examiner is thanked for his kind allowance of claims 9, 11-13, 35, 37-43, 45-48, 53-56, 66, and 68. The Examiner is also thanked for his kind finding of allowable subject matter in claims 3-4 and 28-29 if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 19-21 and 26 have been withdrawn from consideration as the result of an earlier restriction requirement. Claims 10, 14-18, 23-25, 36, 58, and 62 were cancelled without prejudice by prior amendments.

Claims 1, 22, 57, and 61 have been amended to further particularly point out and distinctly claim subject matter regarded as the invention. The text of claims 2-8, 27-34, 44, 49-52, 59-60, 63-65, 67, and 69-70 is unchanged, but their meaning is changed because they depend from amended claims. No "new matter" has been added by the amendment.

Rejections Under 35 U.S.C. § 103

Claims 1-2, 5-8, 22, 27, 30-34, 44, 49-52, 57, 59-61, 63-65, 67, 69, and 70 stand rejected under 35 U.S.C. §103(a) as being allegedly unpatentable over Chang et al. (U.S.

Pat. No. 5,442,719) in view of Stoll (U.S. Pat. No. 5,902,519). The rejections are respectfully traversed.

According to M.P.E.P. § 2143,

To establish a *prima facie* case of obviousness, three basic criteria must be met. First there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in the applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination. *Hodosh v. Block Drug Co., Inc.*, 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986). "The test for an implicit showing is what the combined teachings, knowledge of one of ordinary skill in the art, and the nature of the problem to be solved as a whole would have suggested to those of ordinary skill in the art." *In re Kotzab*, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1317 (Fed. Cir. 2000).

Furthermore, knowledge of applicant's disclosure must be put aside in reaching [the obviousness] determination, and the legal conclusion must be reached on the basis of the facts gleaned from the prior art. MPEP, § 2142. That is, the references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed

invention. *Hodosh v. Block Drug Co., Inc.*, 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986).

Claims 1, 22, 57, and 61

Claim 1, as amended, defines an annealing method including heating the lithium niobate structure in a sealed oxygen gas atmosphere substantially lacking in H₂O, without introducing substantial quantities of undesirable free protons into the lithium niobate structure, and pressurizing the sealed oxygen gas atmosphere to exceed ambient atmospheric pressure. Claims 22, 57, and 61, as amended, also recite an annealing method including the same distinctive features.

The Examiner alleges, in paragraph 4 of the Office Action, as follows:

Chang discloses using an annealing gas of oxygen in a closed chamber and Chang is silent about the presence of H₂O in the chamber. Using a gas in a closed chamber as taught by Chang certainly reads on the gas is lacking in H₂O as claimed (Emphasis original).

It is true, as the Examiner mentioned, that Chang is silent about presence of H₂O in the chamber. However, Chang is also silent about *absence* of H₂O or undesirability of free protons in the substrate. As the Applicant discussed in detail in the previous response, Chang intentionally introduces protons into the substrate (proton exchange waveguide). Thus, although Chang uses a closed chamber, substantial quantities of free protons are still introduced into the substrate in Chang, which would have undesirable effect.

In addition, Chang does not suggest prohibiting H₂O or avoiding introduction of free protons, or mention any undesirable effect of free protons on the modulator, as described on pages 5-6 of the present specification. Such undesirable effect of free protons is solely the Applicant's finding. Furthermore, since Chang uses isopropyl alcohol (hydrogen-containing solvent) as a cleaning agent, such cleaning process of the substrate also introduces substantial quantities of undesirable free protons to the system. Since Chang fails to mention or suggest removing such proton-containing substance before annealing process, and Chang does not care existence of free protons, Chang's annealing process is not without introducing substantial quantities of undesirable free protons into the substrate, as recited in claim 1.

Therefore, when Chang is considered as a whole, i.e., its intentional introduction of protons and use of hydrogen-containing solvent combined with the lack of any suggestion of avoiding H₂O or undesirability of free protons, Chang actually teaches away from avoiding free protons from the system. Accordingly, Chang does not teach or suggest using a sealed oxygen gas atmosphere substantially lacking in H₂O, without introducing substantial quantities of undesirable free protons into the lithium niobate structure, as claimed in claim 1.

In Stoll, as fully discussed in the previous response, the crystal is placed in the chamber directly after steam-heating the crystal in a protonation process. Thus, although Stoll applies "dry, ultra-pure pressurized oxygen" to the chamber, H₂O (steam residue) would be present in the annealing chamber and thus substantial quantities of undesirable

free protons are introduced into the crystal in Stoll. In addition, similar to Chang, there is no suggestion of avoiding H₂O or mention to undesirability of free protons in Stoll.

Accordingly, Stoll also fails to teach or suggest using a sealed oxygen gas atmosphere substantially lacking in H₂O, without introducing substantial quantities of undesirable free protons into the lithium niobate structure, as claimed in claim 1. Thus, even if Chang should be modified by Stoll, the alleged modification still fails to suggest avoiding introduction of substantial quantities of undesirable free protons into the lithium niobate structure, as recited in claim 1.

Accordingly, Chang and Stall, either alone or in combination, do not teach heating the lithium niobate structure in a sealed oxygen gas atmosphere substantially lacking in H₂O, without introducing substantial quantities of undesirable free protons into the lithium niobate structure, as claimed. Since the prior art references fail to teach or suggest all the claim limitations, they do not render the claimed invention obvious. None of other cited references (Chen and Byer) suggests avoiding H₂O from the process, or undesirability of free protons, either.

It should be noted that one of the significant features of the present invention is the combination of using pressurized oxygen and prohibiting water from the process such that substantial quantities of undesirable free protons do not present in the modulators after fabrication. This is because such free-flowing protons would cause DC-bias instability or drift (see page 6 of the specification). The pressurized oxygen keeps the crystal from degrading when water is not present in the annealing process. This

combination, and especially the undesirable effects caused by free protons are the Applicant's findings. The references should not be viewed in the light of the Applicant's own teaching.

Accordingly, it is respectfully requested that the rejection of claims 1, 22, 57, and 61 based on Chang and Stoll be withdrawn.

Dependent Claims

Claims 2-8, 44, 49-50, and 65 depend directly or indirectly from claim 1, and claims 27-34, 51-52, and 67 depend directly or indirectly from claim 22, and thus include the limitations of respective independent claims. Claims 59-60 and 69 depend from claim 57, and claims 63-64 and 70 depend from claim 61, and thus include the limitations of respective independent claims. Thus, the arguments set forth above regarding the respective independent claims are equally applicable here. The base claims being allowable, the dependent claims must also be allowable at least for the same reasons.

Furthermore, with respect to a specific pressure range of the claimed invention, the Examiner also alleges that it would have been "obvious to adjust the pressure/process variable through routine experimentation to obtain the best result." As recited in claims 5, 32, 41, and 47, the claimed invention specifically recites the oxygen pressure range of about 2 psi - 25 psi (i.e., about 0.141 kg/cm² to 1.76 kg/cm²) above ambient atmospheric pressure. Since the pressure range (10-100 atmospheres) of Stoll is much higher than

that of the claimed invention, even though Stoll's teaching might be combined with Chang, the combination would still fail to teach or suggest all the claim limitations.

In addition, the claimed pressure range would not be obvious from Chang, Stoll, or the combination thereof for the following reasons. Chang does not mention any pressurizing of the annealing gas, as discussed above. Stoll discloses iron-doped lithium niobate crystals for holographic applications (column 1, lines 26-29, and 56), and teaches annealing of the crystal by pressurizing a pure oxygen gas as high as 10-100 atmospheres and then heating at around 950°C. Stoll's purpose is to achieve a desired trivalent ion (Fe^{3+}) to divalent ion (Fe^{2+}) ratios without adversely affecting the ability of the lithium niobate crystals to function in holographic applications (column 3, line 65 to column 4, line 1), and there is no mention to any optical waveguides or modulators in Stoll. Thus, the alleged "best result" is limited to that for holographic applications described in Stoll. The claimed pressure range is to avoid the green discoloration as described in the present specification on page 12, line 14 to page 13, line 2. Since Stoll adjusts the oxygen pressure only by the crystal size and mentions nothing about effects of the annealing pressure on discoloring, the claimed pressure range would not be obtained by routine examination with Stoll's teaching.

In view of the foregoing, it is respectfully asserted that the claims are now in condition for allowance.

Request for Allowance

It is believed that this Amendment places the above-identified patent application into condition for allowance. Early favorable consideration of this Amendment is earnestly solicited.

If, in the opinion of the Examiner, an interview would expedite the prosecution of this application, the Examiner is invited to call the undersigned attorney at the number indicated below.

Respectfully submitted,
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Limited Recognition under 37 CFR §10.9(b)

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